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Persistently high prevalence and unrecognized HIV infection among men who have sex with men in Baltimore: the BESURE Study

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Abstract

Background—Given high rates of HIV among Baltimore MSM, we examined characteristics associated with HIV prevalence and unrecognized HIV infection among Baltimore MSM at two time points.

Methods—Cross-sectional behavioral surveys and HIV testing in 2004–2005 and 2008 using venue-based sampling among adult Baltimore men at MSM-identified locations. MSM was defined as sex with a male partner in the past year. Bivariate and backwards stepwise regression identified characteristics associated with HIV and unrecognized infection.

Findings—HIV prevalence was 37.7% overall in 2004–2005 (n=645) and 37.5% in 2008 (n=448), 51.4% and 44.7% among Black MSM, and 12.9% and 18.3% among non-Hispanic White MSM. Compared to non-Hispanic White MSM, Black MSM were 4.0 times (95% C.I.: 2.3, 7.0) more likely to be HIV-positive in 2004–2005 and 2.5 times (95% C.I.: 1.5, 4.0) more likely in 2008. Prevalence of unrecognized HIV infection was 58.4% overall in 2004–2005 and 74.4% in 2008, 63.8% and 76.9% among Black MSM, and 15.4% and 47.4% among non-Hispanic White MSM. In adjusted models, unrecognized infection was significantly associated with minority race/ethnicity, younger age, and no prior year doctor visits in 2004–5 and with younger age and no prior year doctor visits in 2008.

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A preliminary analysis of a subset of participants in one of the two data collection waves reported here was presented at the Conference on Retroviruses and Opportunistic Infections, Denver, CO, February 5–8, 2006 in, entitled: “High HIV Prevalence and Incidence Observed among African-American Men who have Sex with Men in Baltimore: The Behavioral Surveillance Research (BESURE) Study”.

Conclusion—High rates of HIV infection and substantial rates of unrecognized HIV infection among Baltimore MSM, particularly men of color and young men, require urgent public and private sector attention and increased prevention response.

Keywords

MSM; HIV prevalence; Unrecognized HIV infection; Baltimore; Racial disparity

Introduction

Since the late 1990s, the gay community's early success in initiating risk reduction behavior change and slowing the rate of new cases of HIV/AIDS[1–3] has been overshadowed by evidence of a resurgence of HIV/AIDS among men who have sex with men (MSM) in the United States. HIV infection rates among MSM have climbed steadily since the early 1990s, now accounting for more than half of new infections[4]. The rate of new HIV diagnosis among MSM is 44 times higher compared to non-MSM men[5].

Throughout the MSM HIV/AIDS epidemic, Black men have been at particular risk. In 1986, nearly 15 percent of cumulative AIDS cases in homosexual and bisexual men occurred among Black men[6]. By the end of 2007, Black MSM comprised more than a quarter of the cumulative reported AIDS cases among MSM[7] and 35% of new infections among MSM were among African-Americans[8].

Maryland had the second highest estimated AIDS diagnosis rate in the United States in 2008[9]. Baltimore is the location hardest hit by HIV/AIDS in Maryland, accounting for 78% of prevalence in the central region. MSM account for 24% of HIV/AIDS prevalence and represent the only transmission category in central Maryland for which HIV incidence is increasing[10].

There are more new HIV infections among African-American MSM aged 13–29 than any other age or race/ethnic group[8]. In Maryland, 1 in 5 African-American MSM are estimated to be HIV positive, compared to 1 in 24 Hispanic/Latino MSM and 1 in 38 White MSM [11]. The Young Men's Survey showed that young Black MSM in Baltimore had the highest percent prevalence of HIV infection, HIV incidence[12], and unrecognized HIV infection[13] among seven participating cities.

The CDC National HIV Behavioral Surveillance System (NHBS) collects behavioral data among populations at high risk for HIV, including MSM, in selected U.S. areas with high HIV prevalence[14]. Recently released 2008 findings show that 19% of MSM are HIV positive and 44% of HIV positive men are unaware of their HIV status nationwide[15]. HIV prevalence and unrecognized HIV infection was highest among Black MSM. Among participating cities, HIV prevalence ranged from 6% in Atlanta to 39% in Baltimore. Unrecognized infection ranged from 15% in Seattle to 73% in Baltimore. These high rates of HIV and unrecognized infection among Baltimore MSM further bolster a need to understand social and behavioral correlates of HIV in this city.

Research among young MSM in Baltimore shows strong racial disparities in HIV infection [16,17] and HIV incidence [18]. Older age, recent STD diagnosis, and high numbers of sex partners have also been associated with HIV among young Baltimore MSM [16]. It is unknown whether these findings can be generalized to the larger community of MSM in Baltimore. Additionally, little is known about factors associated with unrecognized HIV infection in this population. The NHBS project, known as the Behavioral Surveillance Research (BESURE) Study in Baltimore, recruited MSM in 2005 and 2008. Using data from both BESURE MSM waves, the current paper examined the extent of racial disparity and correlates of HIV prevalence and awareness of HIV seropositivity at each time point.

Methods

Sampling Design and Recruitment

The BESURE Study (NHBS Baltimore) is an HIV infection and behavioral risk cross-sectional survey among populations at high risk for HIV. The methods and sampling for NHBS-MSM have been previously described in detail[15,19]. Two serial cross-sectional waves of venue-based data collection were conducted among MSM in Baltimore. The first was conducted between June 2004 and April 2005 and the second between July and October 2008. Study protocols for both waves were identical.

Formative research included focus groups with MSM and interviews with community informants and public health practitioners to identify current public and private venues (e.g., bars, clubs, businesses, events, neighborhood locations) frequently attended by Baltimore MSM and high-traffic day/time periods for recruitment. Sampling frames were subsequently constructed from the universe of venues and their corresponding day/time periods, and 15 or more venue-day-time periods (i.e., sampling events) were randomly selected and scheduled for recruitment each month. Sampling events averaged 18 per month in both waves.

During each sampling event, study recruiters consecutively approached men who crossed a predetermined intercept area at the venue and assessed eligibility. Eligible participants were: males 18 years or older, Baltimore-Towson metropolitan area residents, and had not previously participated in the current data collection wave; sexual identity or practice did not preclude men from being eligible. Eligible men completed study procedures either in a nearby mobile unit or in study offices at another scheduled time. All study procedures were anonymous. Consent was provided orally and documented in writing by trained interviewers. Consent for HIV testing was provided separately and not required for study participation in either wave. After completing informed consent procedures, participants were interviewed using a handheld computer-assisted standard questionnaire, provided a serum sample for HIV testing, received counseling and referral to prevention services, and received US$50.00 as reimbursement for their time. Follow-up appointments were scheduled within two weeks for HIV test results, post-test counseling, and referral to care or services as appropriate. The protocol and all study materials were reviewed and approved by the Maryland Department of Health and Mental Hygiene and the Johns Hopkins Bloomberg School of Public Health Institutional Review Boards.

Measures

The standardized questionnaire included demographics, HIV-related risk behaviors, medical history, and sexual identity. Race/ethnicity categories were non-Hispanic White, Black, Hispanic, Native American, Pacific Islander, Asian-American or of mixed race (i.e., participants who reported being of more than one racial/ethnic ancestry). Since small numbers of Hispanic, Native American, Pacific Islander, Asian-American, or mixed race participants precluded detailed analysis, a single category called 'Other race' was created in addition to categories for non-Hispanic White and Black. Age was categorized to reflect quartiles of the age distribution of study participants. Being currently homeless was examined as a binary variable, whereas education was reported as the level attained at the time of the survey.

Participants were asked about HIV risk behaviors over their lifetimes and in the prior year. Recent sexual risk behaviors included number of male sexual partners (categorized to reflect quartiles of number of partners), sex with men only or sex with men and women, and unprotected anal intercourse (UAI). UAI was defined as not using a condom during one or more sex acts in the prior 12 months and categorized as 'No UAI', UAI only with a main male sexual partner, or UAI with at least one casual or exchange (i.e., sex in exchange for money or goods) male sexual partner. Lifetime variables included having received a prior HIV test, having injected illicit drugs and having had an STD diagnosis. Behaviors in the past year included having used non-prescribed drugs and having visited a doctor's office. Finally, participants reported whether they had no, public, or private insurance coverage.

Blood specimens with sufficient volume were tested for HIV-1 antibodies by the Maryland Department of Health and Mental Hygiene Laboratories Administration with a U.S. Food and Drug Administration-licensed enzyme immunoassay (EIA) (Sanofi Diagnostics Pasteur, Chaska, MN, U.S.A.). The Maryland DHMH lab confirmed repeatedly reactive samples using Western blot (WB) (Bio-Rad, Hercules, CA, U.S.A. or Epitope, Inc., Organon-Teknika Corporation, Durham, NC, U.S.A.). An HIV-seropositive individual was defined as having a reactive EIA with a positive WB confirmation. Three respondents with indeterminant test results were excluded from the analysis. Unrecognized HIV infection was defined as having a confirmed HIV positive BESURE Study test and either reporting a negative or an unknown prior HIV test result during the survey. This category also included three respondents who refused to report results of their most recent test in the second wave.

Statistical Methods

Sample characteristics between wave 1 and wave 2 were compared using the chi-square statistic. Analyses with HIV positivity as the outcome were restricted to the 645 men and 448 men who reported a same-sex experience within the past year in the first and second cross-sectional waves, respectively, and whose HIV test results were definitive. Analyses of unrecognized HIV infection were restricted to the 243 MSM and 168 MSM who tested HIV positive in the first and second cross-sectional waves, respectively. We assessed patterns of attendance at venues types included in the sampling frame. There was no association between frequency of venue attendance and the two outcomes of interest and data are presented and analyzed without weights.

Associations between demographic variables and HIV risk behaviors with HIV prevalence and HIV unrecognized infection were assessed using the chi-square statistic. Unadjusted prevalence ratios (PR) were calculated with corresponding 95% confidence intervals (95% CI) using SAS PROC GENMOD's log-binomial regression capability with a binomial distribution and a logarithmic link function[21]. Variables that showed a significant association with HIV prevalence or with HIV unrecognized infection ($p \leq 0.05$) were analyzed using the COPY method to directly estimate adjusted prevalence ratios (APR) with their corresponding 95% CI [22]. Both unadjusted and adjusted PROC GENMOD analyses used the REPEATED statement to account for clustering by venue. The PR was deemed as a more appropriate measure of association and a better approximation of the relative risk since the frequency of both outcomes exceeded 15%[23,24]. We arrived at the most parsimonious model by removing variables that were insignificant ($P > 0.05$) using a backwards stepwise approach and as determined by the likelihood ratio test. QIC was used to assess model fit. All statistical analyses were performed using Statistical Analysis Software (SAS) version 9.1.

Results

Participant and sample characteristics

Figure 1 shows recruitment and venue information for both waves. During the first cross-sectional wave (2004–2005), 1,296 men were approached to participate. After eligibility and enrollment, 891 had complete survey and serologic information and 645 reported a same-sex experience in the year prior to the survey (Figure 1). Eligible participants were recruited from 74 venues with mean venue sample size of 8.3 (SD: 14.6; range 1–88). During the second cross-sectional wave (2008), 1,326 men were approached for participation. After eligibility and enrollment, 600 participants had complete survey and serologic information and 448 reported prior year same-sex experience (Figure 1). In wave 2, eligible participants were recruited from 31 venues with mean venue sample size of 13.6 (SD: 9.0; range 2–35).

The demographic and HIV risk behavior composition of the two samples from the two waves differed (Table 1). Compared with the first cross-sectional wave, the second cross-sectional wave was more likely to enroll MSM who reported: Black race; being less than 24 years of age; homelessness; having had 2–3 male sexual partners in the past year; having had male sexual partners only; not having had UAI; using non-injection drugs in the past year; and lifetime drug injection. The two samples did not statistically differ in educational attainment, ever receiving an HIV test, ever receiving an STI diagnosis, health insurance status, or past year doctor visits.

In the first cross-sectional wave, median age was 34 years (range: 18–69), 70% were of minority race, and more than half reported post-secondary education. Most reported being homosexual/gay (63%), never injecting illegal drugs (83%), no STD diagnosis (84%), and had been tested for HIV (87%). In the prior year, 67% had sex with men only and 74% had more than one same-sex partner. About half reported using non-injected illegal drugs of which marijuana (76%) was most common, followed by cocaine (47%), and crack cocaine (25%). Approximately 60% had some form of health insurance and 77% had visited a doctor in the past year. Median time since last HIV test was 276 days.

In the second cross-sectional study, median age was 30 (range: 18–72), 77% were of minority race, and more than half reported post-secondary education. Most reported being homosexual/gay (68%), never injecting drugs (94%), no STD diagnosis (81%), and having ever tested for HIV (90%). Three-quarters had sex with men only and the majority reported multiple male partners in the past year. Among the 59% who reported non-injected illegal drug use, marijuana was most common (89%), followed by cocaine (28%) and crack cocaine (20%). The majority had some form of health insurance and 81% had visited a doctor in the past year. Median time since last HIV test was 305 days.

Prevalence of HIV infection and associated factors

Prevalence of HIV infection by socioeconomic and behavioral characteristics is presented in Table 2 for both cross-sectional recruitment waves. In 2004–2005, 38% of participants tested HIV positive. HIV prevalence by race was 51% among Black MSM, 13% among non-Hispanic White MSM, and 24% among other MSM of color. Table 3 shows the results of univariate and multivariate analyses of prevalent HIV infection for both waves of data collection. In the first wave, minority race, being older than 24 years, having nine or more partners, STD diagnosis, having public health insurance, and a doctor's visit in the prior year were significantly and independently associated with being HIV positive. Older MSM were 1.4–1.8 times more likely to be HIV positive compared to 18–24 year olds. Black MSM were approximately 3.7 times and other race MSM were 2.0 times more likely to be HIV positive than non-Hispanic White MSM.

In the second wave, 38% of participants overall, 45% of Black, 18.3% of non-Hispanic White MSM, and 25% of other men of color tested HIV positive. HIV infection was significantly and independently associated with Black race, UAI with casual or exchange male partners in the prior year (compared to no UAI), and prior STI diagnosis. Risk of being HIV positive among Black MSM was 2.5 times higher than among non-Hispanic White MSM.

Prevalence of Unrecognized HIV infection and associated factors

Prevalence of unrecognized HIV infection by socioeconomic and behavioral factors is shown in Table 2 for both cross-sectional recruitment waves. In the first wave, 58% of HIV positive MSM were unaware of their HIV positive serostatus at the time of enrollment. Of these, 57% reported their most recent test was negative, 20% did not obtain the results of their most recent test, 3% had a recent indeterminant test, less than 1% had never been tested, and 20% did not know results of their most recent test. The proportion unrecognized HIV infection was higher among younger men, from 38% among those 45 years or older to 89% among those 18–24 years of age. By race, the proportion of unrecognized HIV infection ranged from 64% among Black men to 15% among non-Hispanic White participants.

Table 4 shows the results of univariate and multivariate analyses of characteristics associated with unrecognized HIV infection. In the first wave, unrecognized infection was higher among those who reported minority race/ethnicity, younger age, multiple partners, UAI with main partners, no STD diagnosis, no health insurance, and no doctor visit in the past year. In

multivariate analysis, minority race/ethnicity, decreasing age, having 2–3 partners (compared to 1), having no health insurance (compared to private insurance) and not visiting a doctor in past year were significantly associated with unrecognized HIV infection (Table 3). Controlling for these factors, Black MSM were 4 times as likely and other MSM of color were 3.5 times as likely to have unrecognized infection than non-Hispanic White MSM.

In the second wave (2008), 74% of HIV positive participants were unaware of their HIV positive serostatus. Among these, 67% reported their most recent test was negative, 15% did not obtain the results of their most recent test, 4% had a recent indeterminant test, 0% had never been tested, 5.7% did not know results of their most recent test, and 2.4% refused to answer. Seventy-seven percent of Black MSM did not know they were HIV positive, compared to 47% of non-Hispanic White MSM. None of the six HIV positive men of other race/ethnicity were aware of their HIV status. Unrecognized infection was significantly higher among men of other race/ethnicity and who had both male and female partners, but significantly lower among men over 45, those with public insurance (compared to no insurance), and those who had seen a doctor in the past year. In multivariate analysis, men over 45 and those who had visited a doctor in the past year were 35% less likely and approximately 20% less likely, respectively, to be unaware of their HIV infection.

Discussion

These results show high prevalence of HIV infection and unrecognized HIV infection among MSM in Baltimore in 2005 and 2008, particularly among men of color and young men. Two CDC reports have compared HIV prevalence and unrecognized infection rates among MSM in U.S. cities. In 2005, MSM in Baltimore had the highest HIV prevalence and undiagnosed infection rates compared to their counterparts in Los Angeles, Miami, San Francisco, and New York[25] and, in 2008, rates in Baltimore exceeded those of 20 other high prevalence cities[15]. A recent study estimated that racial disparities in MSM HIV infection were highest in Maryland compared to 16 other southern states (Maryland Rate Ratio=7.1, $p<0.001$ vs Total: 4.6, $p<0.001$) [11]. Although it is possible that the NHBS HIV prevalence rankings are confounded by racial differences across cities, the current study confirms the disproportionate HIV burden borne by Black and other minority MSM in Baltimore. There is a very real possibility that the HIV epidemic among MSM may further expand, particularly given the high levels of unrecognized infection among young MSM and UAI among men unaware of their HIV infection.

Despite the different demographic and behavioral compositions of these two recruitment waves, overall HIV prevalence was consistent. These findings corroborate reports of high HIV prevalence among MSM from other cities[24] and expand on prior reports of pronounced racial disparity in HIV among young Baltimore MSM [17,18]. Recent attention to HIV resurgence among U.S. MSM may not fully account for the historically high HIV prevalence among African-American MSM as observed in Baltimore. HIV infection in these studies among adult MSM was much higher than the in 1996–2000 YMS study among young MSM in Baltimore, which reported 12% prevalence overall and 27% among non-Hispanic blacks[16]. Yet the similarity in demographic and behavioral correlates of infection between

this study and the YMS findings suggests that there are persistent prevention needs in Baltimore.

Notably, the majority of men who tested HIV positive in both waves of data collection were not aware of their HIV status. Beginning in 2001, CDC recommended greater emphasis on finding undiagnosed HIV infections[26] and later revised the recommendation to enhance testing in healthcare settings[27]. While the effectiveness and cost of this approach relative to other HIV testing policies has been debated[28], the current study examined the burden of unrecognized HIV infection and racial disparities of unrecognized infections among MSM in Baltimore at two time points following these recommendations. The very high observed proportion of participants who were unaware of their HIV infection suggests that testing efforts are not adequately reaching MSM in Baltimore, particularly minority and young MSM, which in turn limits access to the benefits of HIV treatment and secondary prevention.

Known HIV infection was associated with a doctor visit, suggesting that clinical settings are feasible venues to target some MSM and may be effectively providing testing services. However, many primary healthcare providers miss opportunities to provide HIV testing[29] and counseling[30]. Given the high HIV prevalence rates and multiple risk behaviors, a diverse portfolio of HIV behavioral interventions along with routine testing and counseling will be needed to adequately meet the challenges of the current epidemic. This study utilized a structured venue-based sampling method to recruit participants. A similar methodology for outreach HIV testing efforts and other prevention programming may be viable for increasing service availability for Baltimore MSM.

These findings are subject to numerous limitations. Temporal relationships cannot be determined due to the cross-sectional design in both waves and temporal trend comparisons are not definitive, as they may be due to true differences or the recruitment of different samples. Differential enrollment bias may have occurred between the two waves. Although the study protocols were identical, qualitative differences in implementation may have occurred. The venue universe differed between waves and this may also have contributed to differences between the 2004–5 and 2008 samples. Demographic and HIV risk behavior data were self-reported, and therefore subject to misreporting due to recall or social desirability, concerns about stigma, or cultural differences. Some men who knew their HIV status to be positive may have reported negative status due to perceived stigma or concern about study eligibility, although materials clearly described eligibility and reinforced anonymity and staff members were trained in rapport-building and cultural sensitivity. Lack of disclosure due to stigma concerns may also be a barrier to partner disclosure and a worthy target of prevention efforts. Sexual behavior and drug use measures were summary measures, which may limit interpretation. Findings may not be generalizable to MSM who do not frequent study recruitment venues, who only frequent less well-attended venues, or do not reside in the Baltimore-Towson metropolitan area. There may also be residual bias and underestimation of uncertainty because the data were not weighted by venue attendance patterns and likelihood of recruitment.

Despite limitations, these BESURE surveys provide a needed assessment of urban MSM and a useful foundation for future research and HIV prevention planning. That these two recruitment waves were demographically different but had similar epidemiological profiles suggests a broad need for prevention across the diverse population of Baltimore MSM. These surveys indicate that venue-based recruitment methods are feasible for reaching diverse MSM populations and may be useful for HIV testing and prevention programs. Given that demographic and behavioral characteristics did not alter the association between race/ethnicity and HIV status, it is likely that individual level explanations are insufficient to explain the observed disparities. Input from local community members, providers, and researchers points to the following to combat the strikingly pronounced epidemiological disparities observed here: culturally-sensitive health care and structural prevention approaches to reduce stigma and discrimination toward same-sex behavior and HIV infection; interventions that increase pro-condom use norms; prevention for positives; integration of prevention and medical care; and contextualized prevention strategies that address men who have sex with both women and men. It is imperative to implement interventions that are not only ethnically diverse but also ones that acknowledge and embrace the diversity of ethnic, sexual, and social identities and lifestyles among urban MSM.

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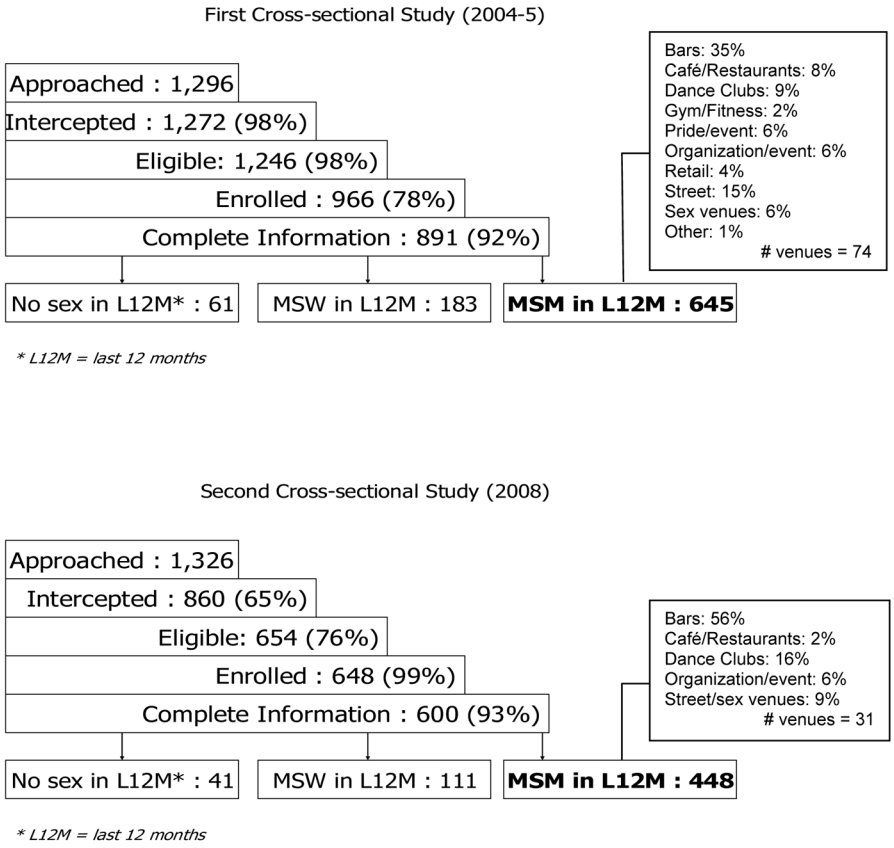

Figure 1.
Recruitment for BESURE study among MSM in Baltimore, 2004–2005 and 2008

Table 1

Sample composition of MSM in Baltimore, 2004–2005 (n=645) and 2008 (n=448)

	Sample Characteristics		
Socio-demographic and behavioral characteristics	**Wave 1 (2004–2005) Total (Column %)**	**Wave 2 (2008) Total (Column %)**	***p*-value**
Total	645 (100)	448 (100)	
Socio-demographic			
Race			
White	201 (31.16)	104 (23.21)	0.0040
Black	403 (62.48)	320 (71.43)	0.0021
Other	41 (6.36)	24 (5.36)	0.4920
Age			
< 24 years old	163 (24.27)	140 (31.25)	0.0299
25–34 years old	166 (25.74)	135 (30.13)	0.1095
35–44 years old	197 (30.54)	108 (24.11)	0.0197
> 45 years old	119 (18.45)	65 (14.51)	0.0868
Current Homeless			
No	625 (96.90)	421 (93.97)	0.019
Yes	20 (3.10)	27 (6.03)	0.019
Education			
High school education or less	316 (48.99)	217 (48.44)	0.8568
College or some college	288 (44.65)	203 (45.31)	0.8288
Graduate education	41 (6.36)	28 (6.25)	0.9432
Sexual Identity			
Homosexual	407 (63.10)	302 (67.71)	0.1164
Bisexual	205 (31.78)	134 (30.04)	0.5420
Heterosexual or other	33 (5.35)	10 (2.24)	0.0165
Sexual Behaviors			
#male sex partners in last 12 months			
One (ref)	165 (25.58)	109 (24.33)	0.6388
2 to 3	182 (28.22)	154 (34.38)	0.0300
4 to 8	149 (23.10)	115 (25.67)	0.3291
9 or more	149 (23.10)	70 (15.63)	0.0024
In past 12 months, any sex with:			
Men only	429 (66.51)	339 (75.67)	0.0011
Men and women	216 (33.49)	109 (24.33)	0.0011
In past 12 months			
No UAI	304 (47.13)	286 (63.84)	<.0001
UAI with main partners only	164 (25.43)	80 (17.86)	0.0031
UAI with casual/exchange partners	177 (27.44)	82 (18.30)	0.0005
Drug Use Behaviors			

	Sample Characteristics		
Socio-demographic and behavioral characteristics	**Wave 1 (2004–2005) Total (Column %)**	**Wave 2 (2008) Total (Column %)**	***p*-value**
Ever injected drugs			
No	534 (82.79)	421 (93.97)	<.0001
Yes	111 (17.21)	27 (6.03)	<.0001
Non-injection drug use in last 12 months			
No	329 (51.01)	184 (41.07)	0.0012
Yes	316 (48.99)	264 (58.93)	0.0012
Health History and Insurance			
Ever been tested for HIV			
No	85 (13.18)	43 (9.62)	0.0722
Yes	560 (86.82)	404 (90.38)	0.0722
Been told by MD had any STD:			
No	542 (84.03)	361 (80.58)	0.1516
Yes	103 (15.97)	87 (19.42)	0.1516
Health insurance			
No health insurance (ref)	230 (36.28)	164 (37.19)	0.2767
Public	146 (23.03)	84 (19.05)	0.2767
Private	258 (40.69)	193 (43.76)	
Visit a doctor’s office in last 12 months			
No	146 (22.64)	87 (19.42)	0.2017
Yes	499 (77.36)	361 (80.58)	0.2017

Table 2

Characteristics of BESURE MSM participants with HIV and unrecognized HIV infection, 2004–2005 and 2008

	HIV positive		Unrecognized HIV infection	
	2004–2005	2008	2004–2005	2008
Socio-demographic and behavioral characteristics	**n (row %)**	**n (row %)**	**n (row %)**	**n (row %)**
Total	243 (37.7)	168 (37.5)	142 (58.44)	125 (74.40)
Socio-demographic				
Race Ethnicity				
Non-Hispanic White	26 (12.94)	19 (18.3)	4 (15.38)	9 (47.37)
Non-Hispanic Black	207 (51.36)	143 (44.7)	132 (63.77)	110 (76.92)
Other	10 (24.39)	6 (25.0)	6 (60.00)	6 (100.00)
Age				
< 24 years old	41 (25.15)	41 (29.3)	36 (87.80)	35 (85.37)
25–34 years old	53 (31.93)	56 (41.5)	36 (67.92)	42 (75.00)
35–44 years old	99 (50.25)	43 (39.8)	51 (51.52)	34 (79.07)
> 45 years old	50 (42.02)	28 (43.1)	19 (38.00)	14 (50.00)
Current Homeless				
No	236 (37.76)	157 (37.3)	138 (58.47)	117 (74.52)
Yes	7 (35.00)	11 (40.7)	4 (57.14)	8 (72.73)
Education				
High school education or less	139 (43.99)	91 (41.9)	86 (61.87)	68 (74.73)
College or some college	98 (34.03)	69 (34.0)	54 (55.10)	53 (76.81)
Graduate education	6 (14.63)	8 (28.6)	2 (33.33)	4 (50.00)
Sexual Identity				
Homosexual	167 (41.03)	119 (39.4)	95 (56.89)	86 (72.27)
Bisexual	63 (30.73)	47 (35.1)	39 (61.90)	38 (80.85)
Heterosexual or other	13 (39.39)	2 (20.0)	8 (61.54)	1 (50.00)
Sexual Behaviors				
Number of male sex partners last 12 months				
One (ref)	52 (31.52)	37 (33.9)	22 (42.31)	28 (75.68)
2 to 3	72 (39.56)	54 (35.1)	49 (68.06)	40 (74.07)
4 to 8	51 (34.23)	50 (43.5)	32 (62.75)	38 (76.00)
9 or more	68 (45.64)	27 (38.6)	39 (57.35)	19 (70.37)
In past 12 months, any sex with:				
Men only	175 (40.79)	135 (39.8)	97 (55.43)	96 (71.11)
Men and women	68 (31.48)	33 (30.3)	45 (66.18)	29 (87.88)
In past 12 months				
No UAI	108 (35.53)	99 (34.6)	58 (53.70)	72 (72.73)
UAI with main partners only	55 (33.54)	26 (32.5)	40 (72.73)	21 (80.77)
UAI with casual/exchange partners	80 (45.20)	43 (52.4)	44 (55.00)	32 (74.42)
Drug Use Behaviors				

	HIV positive		Unrecognized HIV infection	
	2004–2005	2008	2004–2005	2008
Socio-demographic and behavioral characteristics	**n (row %)**	**n (row %)**	**n (row %)**	**n (row %)**
Ever injected drugs				
No	199 (37.27)	160 (38.0)	120 (60.30)	118 (73.75)
Yes	44 (39.64)	8 (29.6)	22 (50.00)	7 (87.50)
Injection drug use last 12 months				
No	232 (38.60)	167 (38.0)	134 (58.01)	124 (74.25)
Yes	11 (25.00)	1 (12.5)	7 (63.64)	1 (100)
Non-injection drug use last 12 months				
No	122 (37.08)	61 (33.2)	67 (54.92)	48 (78.69)
Yes	121 (38.29)	107 (40.5)	75 (61.98)	77 (71.96)
Health History and Insurance				
Ever been tested for HIV				
No	30 (35.29)	15 (34.9)	30 (100.00)	15 (100.00)
Yes	213 (38.04)	152 (37.6)	112 (52.58)	109 (71.71)
Been told by MD had any STD:				
No	188 (34.76)	124 (34.4)	115 (61.50)	96 (77.42)
Yes	55 (53.40)	44 (50.6)	26 (47.27)	29 (65.91)
Health insurance				
No health insurance (ref)	73 (31.74)	66 (40.2)	54 (73.97)	53 (80.30)
Public	85 (58.22)	40 (47.6)	40 (47.06)	29 (72.50)
Private	79 (30.62)	60 (31.1)	44 (55.70)	41 (68.33)
Visit a doctor’s office in last 12 months				
No	38 (26.03)	29 (33.3)	34 (89.47)	27 (93.10)
Yes	205 (41.08)	139 (38.5)	108 (52.68)	98 (70.50)

Table 3

Predictors of positive HIV status among MSM in Baltimore BESURE study 2004–2005 (n=645) and 2008 (n=448)

	Wave 1 (2004–2005) HIV positive		Wave 2 (2008) HIV positive	
Socio-demographic and behavioral characteristics	**Unadjusted PR (95% CI)**	**Adjusted PR (95% CI)[a]**	**Unadjusted PR (95% CI)**	**Adjusted PR (95% CI)[a]**
Socio-demographic				
Race Ethnicity				
Non-Hispanic White	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Non-Hispanic Black	3.97 (2.27–6.96)	3.70 (2.24–6.12)	2.45 (1.49–4.01)	2.46 (1.53–3.96)
Other	1.89 (0.95–3.76)	1.95 (1.03–3.71)	1.37 (0.53–3.56)	1.32 (0.52–3. 35)
Age				
< 24 years old	1.0 (ref)	1.0 (ref)	1.0 (ref)	
25–34 years old	1.27 (0.97–1.66)	1.37 (1.04–1.80)	1.42 (0.96–2.08)	
35–44 years old	2.00 (1.53–2.61)	1.76 (1.39–2.22)	1.35 (0.95–1.95)	
> 45 years old	1.67 (1.18–2.36)	1.76 (1.39–2.22)	1.47 (0.93–2.32)	
Current Homeless				
No	1.0 (ref)		1.0 (ref)	
Yes	0.93 (0.54–1.50)		1.09 (0.63–1.89)	
Education				
Graduate education	1.0 (ref)		1.0 (ref)	
College or some college	3.01 (1.52–5.95)		1.19 (0.61–2.31)	
High school education or less	2.33 (1.11–4.88)		1.47 (0.66–3.22)	
Sexual Identity				
Homosexual	1.0 (ref)		1.0 (ref)	
Bisexual	0.75 (0.52–1.07)		0.89 (0.66–1.20)	
Heterosexual or other	0.96 (0.68–1.35)		0.51 (0.18–1.45)	
Sexual Behaviors				
# of male sex partners last 12 months				
One (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	
2 to 3	1.26 (0.91–1. 72)	1.23 (1.00–1.51)	1.03 (0.78–1.36)	
4 to 8	1.09 (0.73–1.60)	1.12 (0.83–1.52)	1.28 (0.96–1.72)	
9 or more	1.45 (1.12–1.87)	1.31 (1.07–1.61)	1.14 (0.67–1.93)	
In past 12 months, any sex with:				
Men only	1.0 (ref)		1.0 (ref)	
Men and women	0.77 (0.59–1.01)		0.76 (0.53–1.10)	
In past 12 months				
No UAI	1.0 (ref)		1.0 (ref)	1.0 (ref)
UAI with main partners only	0.94 (.75–1.19)		0.94 (0.62–1.42)	0.89 (0.57–1.38)
UAI with casual/exchange partners	1.27 (.94–1.72)		1.51 (1.10–2.09)	1.43 (1.05–1.95)
Drug Use Behaviors				
Ever injected drugs				

Socio-demographic and behavioral characteristics	Wave 1 (2004–2005) HIV positive		Wave 2 (2008) HIV positive	
	Unadjusted PR (95% CI)	Adjusted PR (95% CI)[a]	Unadjusted PR (95% CI)	Adjusted PR (95% CI)[a]
No	1.0 (ref)		1.0 (ref)	
Yes	1.06 (0.75–1.52)		.78 (0.46–1.32)	
Injection drug use last 12 months				
No	1.0 (ref)		1.0 (ref)	
Yes	0.65 (0.26–1.64)		0.33 (0.05–2.23)	
Non-injection drug use last 12 months				
No	1.0 (ref)		1.0 (ref)	
Yes	1.03 (0.85–1.25)		1.23 (0.94–1.59)	
Health History and Insurance				
Ever been tested for HIV				
No	1.0 (ref)		1.0 (ref)	
Yes	1.08 (0.76–1.54)		1.07 (0.71–1.64)	
Been told by MD had any STD:				
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes	1.53 (1.26–1.88)	1.23 (1.06–1.42)	1.47 (1.14–1.89)	1.47 (1.17 – 1.84)
Health insurance				
No health insurance (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	
Public	1.83 (1.15–2.39)	1.32 (1.05–1.66)	1.18 (0.93–1.51)	
Private	0.96 (0.66–1.41)	1.10 (0.81–1.50)	0.77 (0.59–1.04)	
Visit a doctor’s office in last 12 months				
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	
Yes	1.58 (1.20–2.07)	1.43 (1.03–1.96)	1.16 (0.86–1.56)	

[a]All variables with $p < .05$ in the univariate analysis were included in the log-binomial model.

Table 4

Predictors of unrecognized HIV infection among HIV-positive MSM in Baltimore BESURE study 2004–2005 (n=142) and 2008 (n=125)

	Wave 1 (2004–2005) Unrecognized HIV infection		Wave 2 (2008) Unrecognized HIV infection	
Socioeconomic and behavioral characteristics	**Unadjusted PR (95% CI)**	**Adjusted PR (95% CI)[a]**	**Unadjusted PR (95% CI)**	**Adjusted PR (95% CI)[a]**
Socioeconomic				
Race Ethnicity				
Non-Hispanic White	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Non-Hispanic Black	4.14 (1.88–9.13)	3.95 (1.92–8.15)	1.62 (0.95–2.76)	1.39 (.89–2.19)
Other	3.90 (1.58–9.61)	3.48 (1.68–7.21)	2.11 (1.25–3.55)	1.51 (.96–2.40)
Age				
< 24 years old	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
25–34 years old	0.77 (0.63–0.96)	0.88 (0.84–0.93)	0.88 (0.70–1.11)	0.92 (0.83–1.02)
35–44 years old	0.59 (0.48–0.72)	0.75 (0.64–0.88)	0.93 (0.73–1.18)	0.92 (0.83–1.03)
> 45 years old	0.43 (0.25–0.75)	0.55 (0.37–0.84)	0.59 (0.41–0.84)	0.65 (0.45–0.93)
Current Homeless				
No	1.0 (ref)		1.0 (ref)	
Yes	0.98 (0.47–2.01)		0.98 (0.70–1.36)	
Education				
Graduate education	1.0 (ref)		1.0 (ref)	
College or some college	1.09 (0.88–1.34)		1.53 (.82–2.87)	
High school education or less	1.08 (0.68–1.72)		1.49 (0.82–2.73)	
Sexual Identity				
Homosexual	1.0 (ref)		1.0 (ref)	
Bisexual	1.09 (0.86–1.38)		1.12 (.98–1.28)	
Heterosexual or other	1.08 (0.69–1.70)		.69 (.17–2.83)	
Sexual Behaviors				
# male sex partners last 12 mos				
One (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	
2 to 3	1.61 (1.12–2.31)	1.48 (1.10–1.98)	.98 (0.78–1.23)	
4 to 8	1.48 (1.00–2.18)	1.30 (0.98–1.73)	1.00 (0.79–1.27)	
9 or more	1.36 (0.93–1.97)	1.30 (0.98–1.73)	.93 (0.68–1.27)	
In past 12 months, any sex with:				
Men only	1.0 (ref)		1.0 (ref)	
Men and women	1.19 (0.99–1.48)		1.24 (1.08–1.41)	
In past 12 months				
No UAI	1.0 (ref)		1.0 (ref)	
UAI with main partners only	1.35 (1.08.–1.70)		1.11 (.88–.1.40)	
UAI with casual/exchange partners	1.02 (0.80–1.30)		1.02 (.85–1.23)	
Drug Use Behaviors				
Ever injected drugs				

Socioeconomic and behavioral characteristics	Wave 1 (2004–2005) Unrecognized HIV infection		Wave 2 (2008) Unrecognized HIV infection	
	Unadjusted PR (95% CI)	Adjusted PR (95% CI)[a]	Unadjusted PR (95% CI)	Adjusted PR (95% CI)[a]
No	1.0 (ref)		1.0 (ref)	
Yes	.83 (.59–1.16)		1.19 (0.92–1.54)	
Injection drug use last 12 months				
No	1.0 (ref)		1.0 (ref)	
Yes	1.10 (.75–1.60)		1.17 (0.86–1.58)	
Non-injection drug use last 12 months				
No	1.0 (ref)		1.0 (ref)	
Yes	1.13 (0.87–1.46)		0.91 (0.79–1.05)	
Health History and Insurance				
Been told by MD had any STD:				
No	1.0 (ref)		1.0 (ref)	
Yes	0.77 (0.61–.97)		0.85 (0.67–1.10)	
Health insurance				
No health insurance (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	
Public	0.64 (0.49–0.83)	0.84 (0.68–1.03)	0.91 (0.73–.99)	
Private	0.75 (0.55–1.02)	0.88 (0.84–0.93)	0.90 (0.70–1.16)	
Visit doctor’s office last 12 mos				
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes	0.59 (0.50–0.70)	0.88 (0.84–0.93)	0.76 (0.63–0.91)	0.82 (0.71–0.94)

[a]All variables with $p < .05$ in the univariate analysis were included in the log-binomial model